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## Test Procedure for

# DETERMINING ASPHALT CONTENT FROM ASPHALT PAVING MIXTURES BY THE IGNITION METHOD



TxDOT Designation: Tex-236-F

Effective Date: March 2016

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## 1. SCOPE

- 1.1 Use this test method to determine the asphalt content of hot mix asphalt (HMA) paving mixtures using an ignition oven. Use the remaining aggregate for sieve analysis in accordance with Tex-200-F.
  - 1.2 Use this test method to determine aggregate gradation and asphalt content correction factors before the start of production. The type of aggregate in the mixture may affect the ignition procedure. Establish correction factors by testing a set of samples for each mix type produced to optimize accuracy.
  - 1.3 Use this test method to determine the asphalt content and gradation of reclaimed asphalt pavement (RAP) and recycled asphalt shingle (RAS) stockpiles.
  - 1.4 The values given in parentheses (if provided) are not standard and may not be exact mathematical conversions. Use each system of units separately. Combining values from the two systems may result in nonconformance with the standard.
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## 2. APPARATUS

- 2.1 *Ignition oven*, capable of:
    - 2.1.1 Maintaining a temperature to cause combustion with an internal balance thermally isolated from the chamber accurate to 0.1 g. The balance must be capable of weighing a 4000 g sample in addition to the sample baskets.
    - 2.1.2 Providing an audible alarm and indicator light when the sample reaches constant weight.  
**Note 1**—The oven door must automatically lock when the test procedure begins and must remain locked until the test procedure is completed.
    - 2.1.3 Providing initial sample weight, sample weight loss, correction factor, corrected asphalt content (percent), and test time.
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- 2.2 *Tempered stainless steel No. 8 (2.36 mm) mesh basket*, otherwise perforated basket, or combination of baskets. The basket must incorporate a design that confines the sample during testing.
- 2.3 *Tempered stainless steel catch pan*, to fit under the basket assembly.
- 2.4 *Oven*, capable of maintaining a minimum temperature of  $325 \pm 5^{\circ}\text{F}$  ( $163 \pm 3^{\circ}\text{C}$ ).
- 2.5 *Balance*, Class G2, in accordance with Tex-901-K, with a minimum capacity of 17.6 lb. (8 kg) for weighing sample in baskets.
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### 3. SAFETY EQUIPMENT

- 3.1 *Safety glasses or face shield*.
- 3.2 *High temperature gloves*.
- 3.3 *Long sleeve jacket*.
- 3.4 *Heat-resistant surface*, capable of withstanding heat from the sample baskets.
- 3.5 *Protective cage*, capable of surrounding the sample baskets.
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### 4. MISCELLANEOUS EQUIPMENT

- 4.1 *Pan for transferring samples after ignition*.
- 4.2 *Spatulas*.
- 4.3 *Bowls*.
- 4.4 *Wire brushes*.
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### 5. REPORT FORMAT

- 5.1 The [Correction Factor Calculation Report](#) is an Excel template containing the following worksheets:
- Asphalt Content and Combined Aggregate Gradation (Tx236)
  - Summary Sheet (Summary)
- 5.2 **For hot-mix asphalt (HMA) mixtures**, use the [QC/QA Excel template](#) for the Ignition Oven Method in conjunction with the HMA specification. Refer to the Instructions tab for guidelines on how to use the template.
- 5.3 **Use the [Mix Design Excel template](#) to prepare blank samples when establishing correction factors.**
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## 6. CORRECTION FACTORS

- 6.1 Use the Blank Weigh Up worksheet in the Mix Design Excel template to prepare 2 blank samples in the laboratory in accordance with Tex-205-F. Determine the sample size for the blank samples in accordance with Tex-200-F, Table 1.

**Note 2**—Do not add any asphalt binder, fibers, or any recycled materials to the blank samples. Do not perform the ignition oven procedure with the blank samples.

- 6.2 Perform a washed sieve analysis on each blank sample in accordance with Tex-200-F, Part II.

**Note 3**—Enter the individual or cumulative weight of aggregate retained on each sieve on the Asphalt Content and Combine Aggregate Gradation worksheet.

- 6.3 When applicable, enter the gradation of any recycled material used in the mixture design, such as RAP or RAS, in the Asphalt Content and Combined Aggregate Gradation worksheet, under the Recycled Materials Section. Use the gradation of the recycled material determined for the mixture design in accordance with Tex-204-F.

**Note 4**—The Asphalt Content and Combined Aggregate Gradation worksheet calculates the combined gradation of the blank samples and recycled materials, when applicable.

**Note 5**—The combined gradation, including the use of any recycled materials, must fall within the master gradation band of the specification used for the project.

- 6.4 Prepare a “butter batch mix” at the design optimum asphalt content and discard before mixing any other samples for determining correction factors.

**Note 6**—A “butter batch mix” is a trial batch of asphalt and aggregate design mixture used to coat the mixing bowl and whips with asphalt. This helps prevent a loss of asphalt due to adhesion on the bare walls of the bowl or in the mixing whips to ensure an accurate asphalt content of the samples used to determine correction factors.

- 6.5 Use the Weigh Up worksheet in the Mix Design Report to prepare six samples in the laboratory in accordance with Tex-205-F. Determine the sample size in accordance with Section 7.3.

- two at the design optimum asphalt content

- two each at  $\pm 0.5\%$  of the design optimum asphalt content.

**Note 7**— Add the recycled material when preparing the samples, if applicable.

- 6.6 Perform the ignition oven procedure as described under Section 8 with the samples prepared in Section 6.5.

- 6.7 Perform a dry gradation sieve analysis in accordance with Tex-200-F, Part I, on the residual aggregate for each ignited sample from Section 6.6.

**Note 8**—Enter the individual or cumulative weight of aggregate retained on each sieve on the Asphalt Content and Combine Aggregate Gradation worksheet.

- 6.8 *Determining Asphalt Content Correction Factor:*
- 6.8.1 Determine the asphalt content for each ignited sample in Section 6.6 in accordance with Section 9.1.
- 6.8.2 Use the Asphalt Content and Combined Aggregate Gradation worksheet to subtract the measured asphalt content for each ignited sample determined in Section 6.8.1 from the actual asphalt content. Average the six measured differences to determine the asphalt content correction factor.
- Note 9**—When fibers are added to the mixture, the asphalt content correction factor takes into account the percent fibers in the mixture so that the fibers are excluded from the binder content determination.
- 6.9 *Determining Aggregate Gradation Correction Factors:*
- 6.9.1 Use the Asphalt Content and Combined Aggregate Gradation worksheet to subtract the gradation determined in Section 6.7 (ignited samples) for each sieve size from each corresponding sieve size of the combined gradation determined in Section 6.3 (blank samples and recycled material).
- 6.9.2 Average the six measured differences for each sieve size to determine the aggregate gradation correction factor for each sieve size. Report the correction factors in percent passing.
- 6.10 Use the Summary worksheet to report the asphalt content and aggregate gradation correction factors.
- Note 10**—If the aggregate correction factor for a sieve is historically less than 0.5%, a zero correction factor can be used.
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## 7. SAMPLE PREPARATION

- 7.1 *Asphalt Paving Mixtures:*
- 7.1.1 Produce a sample in accordance with Tex-205-F or quarter a sample in accordance with Tex-222-F.
- 7.1.1.1 When the mixture is not sufficiently workable to separate the mix with a spatula or trowel, place it in a large flat pan and warm to  $250 \pm 5^\circ\text{F}$  ( $121 \pm 3^\circ\text{C}$ ) for 30 min.
- Note 11**—Do not heat sample for more than 1 hour.
- 7.1.1.2 For microsurfacing production mix, place the mixture in a large flat pan and dry to constant weight at  $230 \pm 10^\circ\text{F}$ .
- 7.1.1.3 The mixture type controls the recommended sample size, as shown in Table 1.

**Table 1—Recommended Weight of Sample**

Mixture Type	Recommended Weight of Sample, g
Type A, SP-A	3000–4000
Type B, SP-B	2000–3000
Type C, PFC (PG 76), SP-C, CMHB-C, SMA-C, SMA-D, SMAR-C, UTBWC-C, TBPFC (PG 76)	1000–2000
Type D, PFC (A-R), SP-D, CMHB-F, SMA-F, UTBWC-B, TBPFC (A-R)	1200–1500
Type F, SMAR-F, Microsurfacing, CAM, UTBWC-A, TOM-C, TOM-F	1000–1200

7.1.2 Sample sizes should not be more than 400 g greater than the maximum recommended sample mass as shown in Table 1. Large samples of fine mixes tend to result in incomplete ignition of the asphalt.

**Note 12**—When the mass of the sample exceeds the capacity of the equipment used, divide the sample into suitable increments. Appropriately combine the results for calculating the asphalt content (weighted average).

7.1.3 Verify that the mixture contains no more than 0.2% of moisture by weight in accordance with Tex-212-F, Part II. Do not use the same sample used for moisture determination as used for asphalt content determination.

7.2 *Recycled Materials Samples:*

7.2.1 Take a representative sample from the recycled material stockpile in accordance with Tex-222-F.

7.2.2 Oven-dry the sample to constant weight at  $140 \pm 5^\circ\text{F}$  ( $60 \pm 3^\circ\text{C}$ ).

7.2.3 Quarter a test sample to the required size shown in Table 2.

7.2.4 Verify that the mixture contains no more than 0.2% of moisture by weight in accordance with Tex-212-F, Part II. Do not use the same sample used for moisture determination as used for asphalt content determination.

**Table 2—Recommended Weight of Recycled Material Sample**

Recycled Material Type	Recommended Weight of Sample, g
Reclaimed Asphalt Pavement (RAP) <sup>1</sup>	1000–4000
Recycled Asphalt Shingles (RAS) <sup>2</sup>	500–700

1. Refer to Table 1 for recommended sample weights.

2. Sample size exceeding the recommended weight above may not completely ignite the asphalt.

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## 8. IGNITION OVEN PROCEDURE

- 8.1 Pre-heat the ignition oven according to the manufacturer's recommendations.
- 8.2 Determine and record the weight of the basket assembly to the nearest 0.1 g.
- 8.3 Place the loose mixture directly into the sample baskets.  
**Note 13**—Reheat the sample in a 250°F (121°C) oven for 30 min., if it gets cold. Do not reheat microsurfacing, limestone rock asphalt (LRA), or hot-mix cold-laid samples. Do not preheat the sample baskets.
- 8.4 Evenly distribute the sample in the basket assembly, keeping the material away from the edges of the basket.
- 8.5 Weigh and record the sample and basket assembly to the nearest 0.1 g.
- 8.6 Calculate and record the initial weight of the sample (total weight minus the weight of the sample basket assembly) and designate as  $W_S$  in Section 9.1.
- 8.7 Input  $W_S$  into the ignition oven controller. Verify entry of the correct weight.
- 8.8 Open the chamber door and place the sample and basket assembly in the ignition oven.  
**Note 14**—Failure of the oven scale to stabilize may indicate that the sample basket assembly is contacting the oven wall. If this occurs, adjust the sample basket inside the oven.
- 8.9 Close the chamber door and start the test.  
**Note 15**—This should lock the oven chamber for the duration of the test.
- 8.10 Allow the test to continue until the stable light and audible stable indicator indicate the test is complete.
- 8.11 Press the start/stop button.  
**Note 16**—This should unlock the oven chamber.
- 8.12 Open the chamber door, remove the sample, and allow it to cool to room temperature (approximately 45 min.)  
**Note 17**—Do not use a fan to assist in cooling the sample to room temperature due to the possibility of losing fines.
- 8.13 Weigh the sample and basket assembly after ignition to the nearest 0.1 g.
- 8.14 Calculate and record the final weight of the sample (total weight from Section 8.13 minus the weight of the sample basket assembly) and designate this weight as  $W_A$  in Section 9.1.
- 8.15 Calculate the asphalt content of the sample according to Section 9.1.  
**Note 18**—Asphalt content reported by the ignition oven may be used if proven accurate.

- 8.16 Empty the contents of the basket into a flat pan. Use a small wire sieve brush to ensure removal of any residual fines from the basket. Add those fines to the contents in the flat pan.
- 8.17 Use the remaining aggregate for the sieve analysis in accordance with Tex-200-F.
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## 9. CALCULATIONS

- 9.1 Calculate the asphalt binder content of the sample.

- 9.1.1 For hot-mix asphalt (HMA), LRA, hot-mix cold-laid, and recycled materials:

$$AC\% = \left[ \frac{W_S - W_A}{W_S} \right] * 100$$

- 9.1.2 For microsurfacing mixtures:

$$AC\% = \left[ \frac{W_S - W_A}{W_A} \right] * 100$$

Where:

AC% = measured asphalt content

$W_A$  = total weight of aggregate remaining after ignition, g

$W_S$  = total weight of the HMA sample prior to ignition, g.

- 9.2 Report ignition oven test results to the nearest 0.1%.
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## 10. ARCHIVED VERSIONS

- 10.1 Archived versions are available.